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REMARKS

Applicant has previously canceled without prejudice claims 1, 2, 4-6 and 8. Claim 3, 7 and 9 are currently amended. New claim 10 has been added. Claims 3, 7, 9-10 are pending.

Claim 3 is currently amended to state

"...a material containing at least Cr, Ni, Si and Nb by Cr 17 to less than 20 mass %, Ni greater than 10 up to and including 14 mass %, Si greater than 3 up to and including 4 mass %, Nb 0.05 to 0.5 mass %, and the remaining ingredients include Fe and inevitable impurities (C, Mn, P, S or others).

Amendment to claim 3 has narrowed the ranges claimed for Cr, Ni and Si. These narrowed ranges are supported by the specification at page 7, line 23 to page 8, line 13 and by the illustrative examples listed in Tables 1-3, particularly, for example, Material C and Embodiment 3 (page 13, line 21 et seq.). The narrowed ranges in amended claim 1 are within applicant's previously disclosed and claimed ranges and, further, these narrowed ranges are convergent upon the composition of Material C in preferred embodiment 3, namely, for example, Cr 19.0%, Ni 13.1%, Si 3.3%, Mn 0.8%, C 0.04%, P 0.03%, Nb 0.1% by weight, and remainder Fe.

Dependent claims 7 and 9 are currently amended to continue to improve grammatical construction without any change in meaning.

New claim 10 has been added and is supported as to material composition by the language of original claim 1, as well as by the specification at page 4, lines 16-19 and page 7, lines 7-11

("points indicated by a bold line in Fig. 1 (... catalyst tube 10, reforming tube inner cylinder 3, reforming tube inner cylinder upper plate 4, ...) are made of the material according to the invention ...").

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Further support is found at page 9, lines 3-7, and at page 11, lines 7-10

("using the improved stainless material according to the present invention without increasing the wall thickness ...").

Support for claim 10 is further found in Figs. 1-4, wherein the points indicated by a bold line illustrate wall segments of the tube, cylinder and/or plate as a single wall, or single layer. Applicant notes here respectfully that the patent laws allow drawings in a specification to provide written description of the invention [see Vas-Cath, Inc. v. Mahurkar, 935 F.2d 1555, 19 USPQ 2d 1111 (Fed. Cir. 1991) at 1118].

Claim Rejections Under 35 USC 103(a)

The Examiner has rejected claims 3, 7 and 9 for obviousness in view of Konoki et al. (U.S. Patent No. 4,444,732). Applicant respectfully submits that these rejections should be withdrawn for the reasons presented below.

1. Applicant now claims ranges in composition that do not overlap with Konoki:

The Applicant has amended claim 3 to claim a fuel reformer at least partially comprising material containing (in terms of % by mass): Cr 17 to less than 20, Ni greater than 10 up to and including 14, Si greater than 3 up to and including 4, Nb 0.05 to 0.5, and remaining ingredients include Fe and inevitable impurities (C, Mn, P, S or others). The claimed alloy is illustrated, for example, as Material C in Table 1 of the present specification. Material C contains 19.0% Cr, 13.1% Ni,

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3.3% Si, 0.8% Mn, 0.04% C, 0.03% P, 0.1.5 Nb and Fe as remainder.

Konoki discloses a reactor tube having an inner-wall, reacting layer and an outer covering layer. The reacting layer of Konoki comprises Fe-Cr-Mn-Nb heat resisting steel up to 3 wt% Si, 20 to 30 wt% Cr, up to 3 wt% Nb, either zero wt% Ni or containing a small wt% Ni in the presence of a significant wt% manganese (Mn). Therefore, with respect to Ni, Si, Mn, C and Cr, Konoki's reacting layer is clearly different from the applicant's invention as claimed in currently amended claim 3 and new claim 10. Konoki's covering layer is made of Fe-Cr-Ni heat resisting steel comprising up to 2.5% Si, 20-30% Cr and 18-40% Ni (claim 1 and Col. 2, lines 13-27). Therefore, Konoki's covering layer clearly differs from the present invention of claim 3 as currently amended. Konoki et al. does not disclose, teach or suggest a composition of a reacting layer or a covering layer that contains elemental weight percentages that are within the range of the Applicant's claimed invention. There is no overlap.

(a) Clearly different ranges in the percentage of Ni and Si:

Konoki's discloses a reacting layer with Ni not exceeding 10% by weight (see claim 2); however, Konoki illustrates alloy containing 0.55% Ni (column 9, lines 15-16). Inconsistent with this teaching, applicant's Ni content claimed in amended claim 3 and new claim 10 is more than 10% up to and including 14%, and applicant's preferred embodiment illustrated Material C on Table 1 contains 13.1% Ni. Therefore, Ni content as claimed in the present invention is clearly different from that suggested by

Konoki.

Applicant's composition can be distinguished from Konoki clearly by the non-overlapping ranges for Ni and Si in the reacting layer, where the ranges that Applicant claims lie outside the ranges disclosed, taught and suggested by Konoki for the reacting layer and where performance tests show advantage of Applicant's composition for materials having Ni and Si compositions in this claimed range (see Tables 1-3).

(b) Regarding Cr content:

Cr content of Konoki's reacting layer is 20% to 30% in claim 1 and Cr content must be at least 20% (column 7, line 4). Konoki illustrates alloys containing 25.5% or 25.3% Cr (column 8, line 62 and column 9, line 15). On the other hand, Cr content of the present invention as claimed in currently amended claim 3 and new claim 10 is 17% to less than 20%, and the applicant's illustrated embodiment contains 19.0% Cr in Material C on Table 1. This preferred range for Cr in Applicant's preferred composition finds support in Applicant's report of advantageous performance for a material composition containing Cr at 19.0 % Cr by weight (see Material C used in Embodiments 3, 6 and 9 listed in Tables 1-3) Therefore, Cr content of the present invention is substantially different from that of Konoki.

(c) Regarding Mn content:

The present invention defines Mn as present only as one of "inevitable impurities" and Material C is illustrated as containing 0.8% of Mn (Table 1). On the other hand, Konoki defines Mn as an essential component of 6-15% in the claimed

reacting layer. Therefore, the Mn content of the present invention, where a single layer serves both reactive and covering functions simultaneously in a fuel reformer, is clearly different from the Mn content taught by Konoki.

(d) Regarding C content:

The present invention defines C as one of inevitable impurities in claim 1 and Material C contains only 0.04% of C (Table 1). On the other hand, Konoki defines C as an essential component of 0.3 to 1.5% in the reacting layer for improving sigma-brittleness resistance (column 6, lines 48-66). Therefore, Konoki et al. teaches away from the C percentage as claimed in applicant's invention.

(e) Applicant's narrowed ranges are importantly related to advantageous performance.

Table 1 shows Material C having composition in the ranges claimed by applicant in amended claim 1 and new claim 10. It can be seen from Tables 1-3 that the Material C composition confers favorable advantages over those compositions shown with Ni % falling outside of applicant's claimed range. With regard to Si, also, Applicant's Tables 1-3 provide support for arguing an advantage when Si is greater than 3%. Material Z shows composition roughly similar to Material C in all constituents except Si, which is substantially different, being only 0.6 % in Material Z but present in Material C at 3.3%. Table 2 shows that Embodiments 3 and 6 utilize Material C in the reforming tube inner cylinder, the reforming tube inner cyclinder upper plate (area 1) and the catalyst tube (area 2),. whereas Comparative example 3

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utilizes Material Z in areas 1 and 2. Table 3 shows that damage is heavy in areas 1 and 2 using Material Z, yet good performance is recorded for Material C. These results show the discernible and important advantage of utilizing, for example, Si % composition within applicant's claimed range of greater than 3% up to and including 4%. Because of this, the present invention provides advantageous sigma brittleness resistance and cementation resistance simultaneously in a single layer of material (page 20, line 23 to page 21, line 12 of the present specification).

2. Konoki et al. teaches away from Applicant's invention with regard to the relative ratio of Ni to Mn.

Konoki et al., requires "... appropriate amount of Mn ..." (Column 1, lines 47-61) in a reacting layer made of Fe-Cr heat resisting steel free from Ni or composed of Fe-CR-Ni heat resisting steel containing up to 10% of Ni (Col 1, lines 64-69 and Col 2, lines 1-3) where the reactor tube comprises up to 15% Mn (Col 2, lines 19-20), or, alternatively, up to 10% Ni in embodiments comprised of 6-15% Mn in low-nickel Fe-Cr-Mn-Nb-Ni heat resisting steel (Col 4, lines 18-20, and 26-32). Thus, Konoki et al. teaches substantial Mn concentration (6-15% Mn) when nickel is present only up to 10%. This teaching is directly contrary to Applicant's claimed invention wherein Mn is directed to be present only at level of impurity with Ni being always more than 10% up to and including 14% (see amended claim 1 and new claim 10).

Applicant's Tables 1-3 shows consistently positive performance using material composed of Ni at greater than 10% by weight in illustrative embodiments where Mn is from 0.8 to not

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more than 1.5%, i.e., for example, Mn present at percentages typical of inevitable impurities in the material.

In contrasting applicant's claimed material composition with the teaching of Konoki, it is instructive to look more closely at the numerical ratio of Ni to Mn in the reacting layer (that portion of the reformer surface presenting to the reacting fuels). Essentially, the applicant discloses and claims a minimum Ni/Mn ratio of about 6.7 (10.01% Ni/1.5% Mn), which is about four-fold greater than the maximum Ni/Mn ratio of about 1.7 that Konoki's teaching would allow (10.0% Ni/6.0% Mn). In fact, applicant's illustrative Material C has a Ni/Mn ratio of about 16.4 (13.1% Ni/0.8% Mn) differing by almost an order of magnitude from the teaching of Konoki. There is no overlap, then, in the claimed invention with the teaching of Konoki with regard to this important metallurgical ratio.

3. Applicant claims novel material composition in a single-layer construction, whereas Konoki et al. teaches a two-layer construction.

Konoki et al. teaches a two-component composition and two-layer construction, which increases material cost, increases fabrication cost, increases wall thickness and adds weight, in that it requires fabrication of an inner-wall reacting layer firmly bonded within a contacting second "outer covering layer" of surrounding material. Applicant, on the other hand, contrary to Konoki's teaching, claims an invention wherein the above material degradation challenges and other design goals can be solved with a reformer built of material of a single composition. Applicant reduces material cost and wall thickness and achieves lower

fabrication costs and lighter weight. Applicant's new claim 10 claims a fuel reformer having wall portions that are single-layer walls, a clearly distinguishable feature that is not suggested by the teaching of Konoki.

SUMMARY

Applicant has responded to Examiner's rejections by amending pending independent claim 3 to overcome Examiner's rejection. Dependent claims 7 and 9 are currently amended for grammar.

New claim 10 has been introduced as an independent claim, encompassing the features and limitations of claim 3 and including further limitations.

Claims 3,7,9 and 10 are pending and allowable. Applicant requests allowance of these claims. The Examiner is requested to recalculate fees based on the amended claims and encouraged to contact the Applicant's attorney with questions or comments.

Respectfully submitted,

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